WHAT IS CLAIMED IS:

1. A method for estimating digital data received over a potentially noisy channel which adds intersymbol interference or additive noise, or a combination of intersymbol interference or additive noise, the method comprising steps of:

inputting data received from the noisy channel into a SISO MMSE equalizer;

inputting a set of priors over symbol values of the noisy channel including a separate prior for each received noisy channel symbol value, into the SISO MMSE equalizer;

equalizing, by an MMSE equalization in the SISO MMSE equalizer, the data received from the noisy channel and the set of priors over symbol values to produce a symbol value estimate;

mapping output of the SISO MMSE equalizer onto priors over the symbol values to produce a confidence indication in each of the symbol value estimates as a function of time.

2. The method according to claim 1, further comprising a step of setting parameters of the SISO MMSE equalizer according to MMSE criterion ~~over statistics of~~ the channel noise and ~~statistics of~~ the symbol values.

3. The method according to claim 1, wherein digital data transmitted over said potentially noisy channel is error correction encoded prior to transmission, the step of mapping output of the SISO MMSE equalizer comprising steps of:

passing output of the SISO MMSE equalizer into a SISO error correction decoder;

using an output of said SISO error correction decoder as the set of priors over symbol values;

repeating all steps of the method until a predetermined convergence criterion is reached between said SISO error correction decoder and said SISO MMSE equalizer.

4. The method according to claim 3, wherein digital data transmitted over said potentially noisy channel is interleaved prior to transmission and a step of de-interleaving is conducted on the output of the SISO MMSE equalizer prior to said step of passing output of the SISO error correction decoder is interleaved prior to said step of repeating.

5. The method acording to claim 4, wherein said step of equalizing excludes symbol value estimates which are functions of an input distribution of a current symbol being equalized.

6. The method according to claim 5, wherein said SISO error correction decoder has its output restricted to exclude symbol value estimates which are functions of an input distribution of a current symbol being decoded.

7. The method according to claim 1, wherein said step of equalizing comprises a fast update equalization of the order M^2 (quadratic in the number of parameters M) which exploits redundant computations in successive equalizer computations.

8. The method according to claim 7, wherein the fast update equalization is performed by applying the matrix inversion lemma to a matrix to be inverted in a design of equalization coefficients for the SISO MMSE equalizer.

9. The method according to claim 1, wherein said data is multi-dimensional and is error correction encoded then interleaved prior to transmission in the channel, and wherein said SISO MMSE equalizer handles single-input multiple output data, the mapping step comprising steps of:

de-interleaving outputs of the SISO MMSE equalizer and re-serializing data output from the SISO MMSE equalizer into one-dimensional encoding;

SISO decoding the re-serialized output of the SISO MMSE equalizer; and

repeating said equalizing and mapping steps until a predetermined convergence criterion is met between said equalizing and SISO decoding steps.

10. A method for equalization and decoding of digital data received over a multiple noisy channels which each add intersymbol interference or additive noise, or a combination of intersymbol interference or additive noise, wherein data transmitted over each channel is interleaved prior to transmission, the method comprising steps of:

performing a soft equalization for each channel by

inputting data received from said one of the noisy channels into a SISO MMSE equalizer;

inputting a set of priors over symbol values of the noisy channel including a separate prior for each received noisy channel symbol value, into the SISO MMSE equalizer;

equalizing, by an MMSE equalization in the SISO MMSE equalizer, the data received from the noisy channel and the set of priors over symbol values; and

mapping output of the SISO MMSE equalizer onto priors over the symbol values to produce a confidence indication in each of the symbol values as a function of time,

then, using de-interleaved output from said mapping step for one channel, iteratively decoding information for a second channel by repeating said performing a soft equalization

while substituting said de-interleaved output for said set of priors and substituting output from said mapping step for said second channel for said data received until a predetermined convergence criterion is reached.

11. A data decoding device comprising:

a SISO MMSE equalizer;

a SISO decoder, the decoder exchanging symbol estimates with the SISO MMSE equalizer, the SISO MMSE equalizer produces MMSE linear estimates of transmitted symbols $\hat{b}[n]$, and mapping the linear estimates to an output set of priors over the symbols π^{E}_{OUT}.

12. The device according to claim 11, wherein said equalizer maps the estimates by treating the output distribution $\hat{b}[n]$ as conditionally Gaussian, and distributed about the symbol values.

13. The device according to claim 12, wherein the output distribution mapping is defined as:

$$Prob\{b[n]=1\,|\,\hat{b}[n]\} = \frac{1}{2}\left(1 + tanh\left(\frac{\hat{b}[n]}{\sigma^2_{\hat{b}}}\right)\right),$$

where $\sigma^2_{\hat{b}}$ is the variance of the conditional output distribution given the symbol $\hat{b}[n]$ = sign ($\hat{b}[n]$). and the estimate $\hat{b}$[n] cannot be a function of π^{E}_{IN}[n], and expectations are taken over a distribution of the symbols which excludes π^{E}_{IN}[n] for the calculation of $\hat{b}$[n].

14. The device according to claim 12, wherein the following steps for computing the output distribution given the observations, x[n] and the input distribution π_{IN}^{E} is used by the MMSE equalizer:

a. Create buffers for the priors, the signal x[n], the expectations $\vec{bb}\,[n] = E\{b[n]\vec{b}[n]\}$, the correlation matrix $B[n] = E\{\vec{b}[n]\vec{b}[n]^T\}$, and the means $\vec{mb}\,[n] = E\{\vec{b}[n]\}$

$$\vec{\pi}^{(n)} \triangleq [\pi^{(n)}[-N_1 - L_2], \ldots, \pi^{(n)}[0], \ldots, \pi^{(n)}[N_2 + L_1]]^T$$

$$\vec{x}^{(n)} \triangleq [x^{(n)}[-N_1], \ldots, x^{(n)}[0], \ldots, x^{(n)}[N_2]]^T$$

$$\vec{bb}^{\,(n)} \triangleq [bb^{(n)}[-N_1 - L_2], \ldots, bb^{(n)}[0], \ldots bb^{(n)}[N_2]]^T = [0, \ldots 0, 1, 0, \ldots, 0]^T$$

b. Initialize buffers for priors $\vec{\pi}^{\,(n)}$ and data $\vec{x}^{(n)}$, in terms of the signal x[n] and the input π_{IN}^{E}.

$$\vec{x}^{(0)} = [0, 0, \ldots, x[0], x[1], \ldots, x[N_2]]^T$$

$$\vec{\pi}^{(0)} = [0, 0, \ldots, 0, \pi_{IN}^{E}[0], \pi_{IN}^{E}[1], \ldots, \pi_{IN}^{E}[N_2 + L_1]]^T$$

c. Loop over the data for n= 0, . . ., N:

$$\pi^{(n)}[0] = \tfrac{1}{2}$$

$$\vec{mb}^{\,(n)} = 2\,\vec{\pi}^{(n)} - 1$$

$$B = \vec{mb}^{\,(n)}\,\vec{mb}^{\,(n)T}$$

$$\mathrm{diag}(B) = \mathrm{diag}\,(1, 1, \ldots, 1)$$

$$\vec{c}[n] = [H\,(B - \vec{mb}^{\,(n)}\vec{mb}^{\,(n)T})\,H^T + \sigma_w^2 I]^{-1}\,H\,\vec{bb}^{\,(n)}$$

$$\hat{b}[n] = \vec{mb}^{\,(n)} + \vec{c}^{(n)T}(\vec{x}^{(n)} - H\,\vec{mb}^{\,(n)})$$

$$\vec{x}^{(n+1)} = [x^{(n)}[-N_1 + 1], \ldots, x^{(n)}[N_2], 0]$$

$$\vec{\pi}^{(n+1)} = [\pi^{(n)}[-N_1 - L_2 + 1], \ldots, \pi^{(n)}[N_2 + L_1], 0]$$

if $n < N - N_2$

$$x^{(n+1)}[N_2] = x[n + 1 + N_2]$$

if $n < N - N_2 - L_1$

$$\pi^{(n+1)}[N_2 + L_1] = \pi_{IN}^{E}[n + 1 + N_2 + L_1]$$

d. Estimate output variance $\sigma_{\hat{b}}^2 = (var(\hat{b}\,|\,\hat{b}>0) + var(\hat{b}\,|\,\hat{b}<0))/2$

e. Determine output priors, $\pi^{E}_{OUT} = 1/2\ (1 + tanh\ (\frac{\hat{b}[n]}{\sigma^{2}_{\hat{b}}}))$.